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(54) Title: Sound-insulating suspension for a pipe, in particular an exhaust pipe

(73) Patented for: Volkswagenwerk AG, 3180 Wolfsburg

(72) Inventors: Sorgatz, Ulrich, Dr.-Ing.; Weber, Otto, Ing.(grad.); 3180 Wolfsburg;  
Bätge, Dieter, 3301 Rotenkamp

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(56) Documents taken into account in evaluation of the patentability of content:

DE-PS	12 75 892	US	36 80 851
DE-PS	9 53 941	US	34 73 836
DE-PS	8 14 363	US	33 35 689
DE-Pat. Appln. E 2	877 XII/47a of 28.06.51	US	32 79 779
DE-OS	24 15 536	US	32 70 992
US	37 79 536		

1. Sound-insulating elastic suspension for a pipe, in particular the exhaust pipe of the internal combustion engine of a motor vehicle, with a hanger of rubber-like material, that contains integral webs in its middle section,

characterised in that

an insert (9), elastically deformable in the plane of the hanger (5), of high tensile strength and forming a closed loop, is embedded into the rubber-like material (10); this surrounds the middle section (11) of the hanger (5) and possesses an initial shape that approximates to a rhombus.

2. Suspension in accordance with claim 1, characterised in that the insert (21) is made out of steel wire.

3. Suspension in accordance with claim 1, characterised in that the insert is made out of a spring steel band (9) in a manner known per se,

4. Suspension in accordance with one of the claims 1 to 3, characterised in that the webs (24, 25) form a cruciform configuration lying obliquely to the direction of the suspension forces.

5. Suspension in accordance with one of the claims 1 to 3, characterised in that the webs (12, 13) run essentially parallel to the direction of the suspension forces and, in the direction at right angles to this, face each other so as to form a gap (14) between the web sections that curve towards each other.

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The invention concerns a sound-insulating elastic suspension in accordance with the characterising clause of the main claim.

From DE-OS 24 15 536 such a design is of known art for the suspension of the exhaust pipe of a motor vehicle engine. The hanger made out of a rubber-like material extends between hook-shaped extensions, one on the chassis of the vehicle and the other on the exhaust pipe. As a consequence of the relatively soft spring characteristic, a hanger of this kind provides good vibration insulation and noise suppression. However, it has the disadvantage, particularly when used in relatively harsh environmental conditions, that it is inclined to crack and split.

In these circumstances, instead of a hanger of rubber-like material, the use of a correspondingly shaped component made out of a more durable material, for example spring steel, might be considered. Components of this kind operating as hangers would, however, have the disadvantage that as a result of the progressive characteristic, favourable with reference to strength and shock absorption capability, noise could be produced or be transmitted. Here it should be noted that when using a hanger configured in this manner to mount the exhaust pipe of a motor vehicle, for example, vibration excitation occurs at relatively high frequencies of between 150 and 200 Hz.

Accordingly, the problem underlying the invention is the development of a sound-insulating elastic suspension in accordance with the characterising clause of the primary claim, such that on the one hand it ensures good vibration isolation by means of a relatively soft spring characteristic, but on the other provides good strength and shock absorption capability by means of a progressive characteristic.

The solution of this problem, in accordance with the invention, is characterised by the features of the primary claim.

It is indeed true that the documents disclosed for German patent application E2 877. 47a, 17, describe a spring configured as a rubber-metal unit in which the spring characteristics of a metal spring, and those of a rubber body located between the surfaces of the metal spring, are superposed. However, what is missing is the shaping, appropriate to the invention, that is designed to achieve a sound-insulating suspension that at the same time can withstand mechanical loading.

The rhombus-like insert made, for example, out of steel wire or a spring steel band, gives the suspension, appropriate to the invention, a strongly progressive spring characteristic that can also be non-linear. As a result of the shape chosen, where two corners (or sections with more severe curvature) of the insert lie between the links and are laterally displaced from the line connecting the links, a bending loading is produced first of all, with varying lever arms, and finally a tensile loading. In contrast the webs made out of rubber-like material possess a linear characteristic. The webs are therefore configured with the aim of achieving a desired spring characteristic, while they must also serve, in particular, to limit the deformation of the suspension in the direction parallel to the forces acting on the suspension.

The combination, appropriate to the invention, of rubber-like material with inserts possessing a progressive spring characteristic brings together the advantages of the two materials used without having to accept their disadvantages.

In the following paragraphs two design examples of the invention are described with the aid of figures, where Figs. 1 and 3 represent frontal views of the hangers and Fig. 2 represents the cross-section denoted by II-II in Fig. 1.

The design example shown by Figs. 1 and 2 is considered first. The hanger, denoted in general terms by 5, extends between the hook 2 welded to the vehicle chassis 1 on the one side and the hook 4 welded to the exhaust pipe 3 of the internal combustion engine (not shown) on the other. It exhibits two slits, as 6 and 7, curved in the plane of the hanger to accept the hooks 2 and 4.

The hanger includes an edge section 8 in which the insert 9 is embedded, made in this design example out of a spring steel band. This insert is therefore, as can be seen in Fig. 2 particularly, directly surrounded by the rubber-like material 10 of the hanger 5. In the view according to Fig. 1 the insert 9, and hence the edge section 8 of the hanger 5, possess the approximate shape of a rhombus with sharply rounded corners.

The insert 9 surrounds a middle section 11 of rubber-like material, in this design example forming two webs 12 and 13 extending essentially in the direction of the suspension forces. These webs enclose the gap 14 with curved sections that are facing each other, the gap extending correspondingly in the direction of the suspension forces. For a prescribed displacement of hooks 2 and 4 towards each other, and hence a displacement of the exhaust pipe 3 towards the chassis 1, the opposing surfaces of the two webs 12 and 13 make contact and limit elastically the upwards movement of the exhaust pipe 3.

The hanger 20 in the design example shown by Fig. 3 also contains an insert 21 in its edge section 22 possessing the approximate shape of a rhombus, that once again can be made out of a spring steel band or a steel wire. Here, however, the middle section 23 contains two interpenetrating webs 24 and 25, that form an approximately cruciform configuration, the cross lying obliquely to the direction of the suspension forces. When the hooks (not shown), inserted into the slits 27 and 28 in the rubber-like material, move towards each other, the webs 24 and 25 are loaded in tension.

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In addition 1 sheet of figures

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Drawings sheet 1

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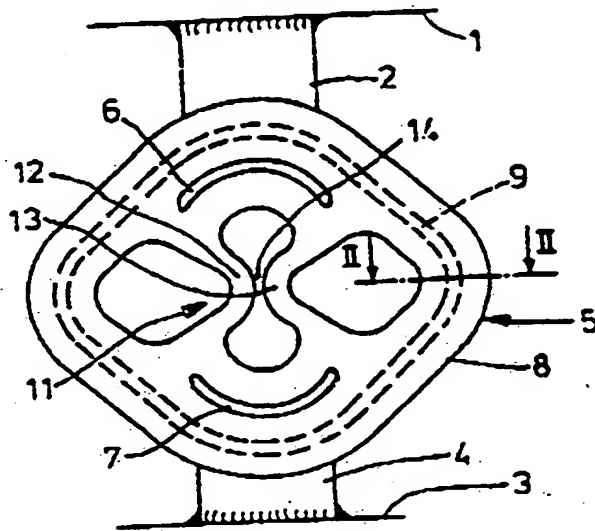


Fig. 1

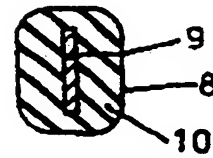


Fig. 2

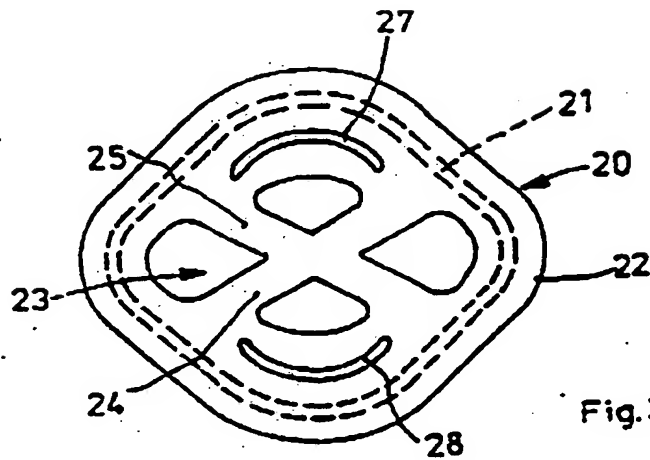


Fig. 3